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ON SOME PECULIARITIES OF VARIABLE GEOMAGNETIC
FIELD IN THE REGION OF SOUTH-POLAR OBSERVATORY
MIRNY

When the first magnetograms were obtained at the South-Pole observatory Mirny attention was drawn to an unusually great variability of the vertical component and almost systematic excess of K-variations of this component over K-variations of both horizontal components.

Such phenomena were not observed at anyone of the permanently operating stations of the Soviet Arctic sector as well as at temporary magnetic stations on drift ice of the General Arctic basin.

The magnetic pavilion in Mirny is set up at a distance of 50 metres from the edge of the ice barrier on the outcrops of crystal rocks and there was danger of induction influence of these rocks.

In this connection in several points near the magnetic pavilion, and at a distance of 13 km from it farther inland and at sea on the shore-ice observations were conducted with the help of a field variation station.

These additional records permit to establish the presence of an exceptionally great K-variations' horizontal gradient of the vertical component, the declination near the magnetic pavilion and an essential decrease of the variability of the vertical component in points, that are situated inland as well as farther to the sea from the magnetic pavilion, due to the attenuation of small fluctuations with a small period, the complete general similarity between the variations recorded at all temporary points of registration and the variations recorded at the magnetic pavilion being preserved.

It was established that magnetic anomalies caused by the outcrops of rocks in the region of Mirny do not exceed

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1000 gammas on H and Z.

The magnetic susceptibility of these rocks appeared to be equal to $2500 \cdot 10^{-6}$ cgs.

Simple estimates show that the peculiarities of the variable magnetic field in the region of the South-Pole observatory Mirny can not be accounted for by induction influence. Another explanation should be sought for which would be in some way connected with the striking similarity between the irregular part of variations on the vertical component and the variations of telluric currents which was also noticed in Mirny. This similarity is violated only during some day time hours of the maximum magnetic-ionospheric disturbances in this region.

Since some regularity began to show in the change of K-variations' amplitudes only for the vertical component and the declination while no peculiarities were observed on the horizontal component a detailed study of the character of the change of K-variations' amplitudes depending upon the location of an observation point was made in the direction of the first magnetic vertical from the magnetic pavilion with the help of field variation stations and by means of visual observations during the disturbances on BMZ and QHM (on QHM variations of the declination were observed). The following regularities were established in the process of this study.

The values of the amplitudes of the irregular part of geomagnetic variations at a distance of 2.5 km from the shore on the continent and of 10 km from the shore at sea are close to each other. They were accepted as normal.

The nearer to the shore from the continent the greater are K-variations' amplitudes which increase gradually and on the very shore achieve the greatest value exceeding the normal by 30%. Then the farther away from the shore into the sea the smaller are these values which decrease sharply and become normal at a distance of 300 m from the shore. The points still farther away from the shore into the sea

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are characterized by values smaller than normal. At a distance of 1 km from the shore the second extreme point is observed where the value of K-variations' amplitudes on the vertical component is smaller than normal by 15%. And still farther in the sea the gradual approach of it to the normal value is observed.

The changing of the amplitude value of the K-variations of declination for the same cross-section has only one extreme point at a distance of 300 m off the shore. In this point the amplitudes of the variations of declination exceed the normal value by 30%. They sharply increase away from the shore and then still farther into the sea they slowly decrease approaching the normal value.

Such sharp and regular changes were not observed for the amplitudes of K-variations on the horizontal component for this cross-section.

It should be mentioned that in the region of Mirny the declination equals $78.^\circ 5$ and the first magnetic vertical approximately coincides with the normal to the shore line in this region.

To construct the curves (described above) of the dependence of the values of K-variations' amplitudes upon the location of the observation point we measured mainly the amplitudes of elementary disturbances (Clear elementary disturbances in Mirny on Z and D have different signs). Due to this fact we were enabled to use the curves of the change of K-variations' amplitude values for harmonic analysis of the observations on the cross-section indicated above dividing the variable field into exterior and interior parts and connecting beforehand these curves with the elementary moderate disturbances ($\alpha, Z = -160^\circ$ and $D = 90^\circ$), recorded in the magnetic pavilion of South-Polar observatory Mirny.

The analysis showed that in the region of Mirny the interior part of the disturbance field is approximately twice

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as much as the exterior one.

The cause of such unusual relation between these parts is unlikely to be anything that can be discovered at a considerable depth in the Earth. Undoubtedly, the shore effect on geomagnetic variations that is found in Mirny is conditioned by the electric current induced in the ocean and characterized by an anomalously great density in the shore region.

Direct proof. of this was obtained through the registration of electric currents in the sea. The value of the variations' vector of the gradient of the potential of currents in the sea, at a distance of 10 km off the shore, appeared to be almost an order less than in the immediate vicinity of the shore in the region of the South-Pole observatory Mirny.

It should be expected that the shore effect on geomagnetic variations to this or that extent must be observed everywhere on the ocean-land boundary. Depending upon the predominant direction of currents induced in the sea the greatest effects on geomagnetic variations may be observed either in the regions of capes extended into the sea or in the regions of straits and bays cutting deep inland.

Taking into account that the data of magnetic observatories are widely used for quantitative estimates of many geophysical processes and constants it should be recommended to all coast magnetic observatories (especially to polar and equatorial observatories where the inducing ionosphere current systems are particularly intensive) to conduct in near future a detailed study of the character of geomagnetic variations and earth currents for the obtaining of quantitative estimates of the shore effect in the region of each magnetic observatory.